

Inquiry Lesson Plan

Grade/Content Area	Grade 8 / Mathematics
Lesson Title	<i>The Human Number Line</i>
State Standards: GLEs/GSEs National Content Standards:	<p><u>GLEs/GSEs:</u> M(N&O)–8–2 Demonstrates understanding of the relative magnitude of numbers by ordering or comparing rational numbers, <u>common irrational numbers</u> (e.g., $\sqrt{2}$, π), numbers with whole number or <u>fractional bases</u> and whole number exponents, <u>square roots</u>, absolute values, integers, or numbers represented in scientific notation using number lines or equality and inequality symbols. (Local)</p> <p><u>Common Core Standards:</u></p> <ol style="list-style-type: none"> 1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. 2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations. <p><u>National Content Standards:</u></p> <ul style="list-style-type: none"> • work flexibly with fractions, decimals, and percents to solve problems; • compare and order fractions, decimals, and percents efficiently and find their approximate locations on a number line; • develop meaning for percents greater than 100 and less than 1; • develop meaning for integers and represent and compare quantities with them.
Context of the Lesson <i>Where does this lesson</i>	The students have just finished learning about irrational numbers, scientific notation, and negative exponents. This is going to be a review of some of the topics the students have

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<p><i>fit in the curriculum and instructional context? Is it the opening of a unit or a series of lessons?</i></p>	<p>learned in the past. With this in mind, students will be investigating the idea of how numbers are placed on the number line. This lesson will take all of the class period to complete.</p>
<p>Opportunities to Learn</p> <p><i>Differentiation: Materials, Learners and Environments</i></p>	<p>Plans to differentiate instruction:</p> <p>The main purpose of this activity is for students to understand the relative magnitude of numbers that they have worked with in the past. The students will each be given 3 sets of note cards that will contain some sort of mathematical problem on it. Students will first work independently to try to figure out what their number is. The students will then work together to make sure the number each student came up with is correct. Once the group has decided each calculation is correct, the students will go to the board and put their numbers in order as they would appear on the number line. The problem solving aspect of this activity is review for the various types of numbers the students have seen thus far. This activity could later be revisited before students work with inequalities or graphing the roots of a function later in the year. The main idea behind this activity is to get the students thinking about quantities and the various ways they can be represented either on a graph or in a numeric form. Working independently, with peers, and moving around are all ways in which students will have the opportunity to learn the relative magnitude of numbers.</p> <p>Accommodations and modifications:</p> <p>The students will be grouped heterogeneously by ability. By ability, I mean I will look at the statistics of the class and group those “higher achieving” students with “lower achieving” students based on grades in the class, and I will spread them throughout the room as much as possible. If the students do not solve their problems on the cards in the time they are first given, they will next have the opportunity to have their group members show them how to solve it. The group will be unable to put their cards up until each member agrees that a card has the correct answer on it. Only at that point will they be able to begin putting the numbers in order. For students with severe disabilities, I will give them cards that are less difficult to solve. Otherwise all students will complete this task together with the same directions.</p> <p>Environment factors:</p> <p>The four groups of students will each be in a section of the room with a poster board and some tape at it.</p>

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	Materials: <ul style="list-style-type: none"> - Note cards with the given problems on them - Poster board - Tape
Objectives	<ul style="list-style-type: none"> - The student will demonstrate an understanding of rational and irrational numbers by first solving an equation or simplifying an expression. This will show that the students are able to take irrational numbers and write them as rational numbers as well as understand that such numbers can be results of an equation or an evaluated expression. - Given a list of numbers, the student will be able to sort them in order as they would appear on a number line by not only placing them in the correct order, but also spacing the numbers properly.
Instructional Procedures	<p>LAUNCH: At the beginning of class, I will have an index card on every student's desk. Throughout the lesson, I will ask them to jot down specific thoughts to be handed in at the end of class.</p> <p>I will begin the class by listing numbers on the board such as $\sqrt{2}$, π, $\frac{1}{4}$, 3^{-1}, 5.4×10^3, 25%, 0.0000000, .3333..., \$.25, $5\frac{3}{4}$, and $\sqrt{80}$. As the students are filing in, I will ask them to think about what these numbers are in terms of what the students are used to seeing.</p> <p>"Good morning class! As you are all coming in please take a look at the board and think about what these numbers are. Try to think about how you could rewrite them in terms of what you are used to seeing. For example, $\sqrt{8}$ is somewhere between 2 and 3 since $\sqrt{4}$ is 2 and $\sqrt{9}$ is 3. Therefore we can conclude that $\sqrt{8}$ is larger than 2 and very close to 3. How could we now write this? Or What is a number that is equivalent to this one?" – I will be looking for an answer similar to 2.8 or 2.9</p> <p>"Now, looking at these numbers, which ones have the same location on the number line?" – Students will respond by saying $\frac{1}{4}$, 25%, and \$.25. They will also point out that 3^{-1} and .3333... are the same.</p> <p>"Nice job everyone! So now what does it mean to write different numerical expressions for the same value? Why would we write them differently in certain situations? Think about this for a minute and write down some ideas on your</p>

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	<p>index card that I gave you at the beginning of class.”</p> <p>“Now before we begin our fun activity planned for today, in your seats try to write these numbers on the board in order from least to greatest as they would be seen on a number line. I will give you about 5 minutes to try, and then I will have you compare answers with a neighbor.”</p> <p>As they are doing this, I will walk around and place the note cards for the activity on the students’ desks faced down. I will also be looking to see the students’ initial thoughts about a number line and how they feel the above numbers are graphed on it. Once the comparison of answers has died down, this is where I want to talk about spacing and what a number line looks like.</p> <p>“How do you guys feel about putting numbers in order? Did you space your numbers correctly? Why is spacing important?”</p> <p>I will then put an example up on the board to display the locations of a few numbers and how they should be spaced. The students will be able to reference this image throughout the activity.</p> <p>“Is anyone having trouble with this? Do you have any questions?”</p> <p>If students have further questions, I will answer them depending on what they ask. For example, if a student asks about how to rewrite a number in rational form, I can show them a quick example. Otherwise I want the students to communicate in their groups and learn from one another. If students do not have any further questions I will explain the activity to them.</p> <p>“Alright everyone, on your desk I have placed 3 colored note cards. You are going to be working with other students in the class who have the same colored note cards as you. Take a minute to get into your groups before I explain what you will be doing.”</p> <p>“First everyone in the group will be working independently on the note card with the number 1 on it. Some of you may have equations to solve, while some of you may just have to evaluate expressions. For example, If I gave you an</p>
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	<p>expression such as 3.2×10^3, How could we write this?"</p> <ul style="list-style-type: none">- I am looking for a response of 3200. <p>"Good, now you will have about 2 minutes to complete the first card. Once everyone in the group seems to have completed this first note card, you will have 5 minutes to discuss each answer with your group and make sure everyone agrees with what you said. Once you have all agreed that everyone has evaluated their card correctly, you can go up to the poster board and put the cards in order as you would see them on a number line."</p> <p>"Once your group has agreed that the first set of note cards is in order, you can move on to the card labeled number 2 and repeat this process again. You will have 3 minutes to evaluate card #2, and 5 minutes to discuss with your group. For card #3, you will have 5 minutes to work independently and 8 minutes to discuss. I will let you know when the times are up. Does anyone have any questions?"</p> <p>If students do not have any questions and understand what they are doing, I will move on to the explore phase.</p> <p>EXPLORE:</p> <p>As the students are working independently I will walk around to answer any questions the students may have about what they should be doing. If students are not getting the correct answers, I will try to ask them questions such as "How did you come up with that number? Does your answer make sense? How far away is that number from 0 on the number line?"</p> <p>Once I feel that students are on task, I will go around to check and see if their numbers are in the correct order and spaced correctly. If I find that a group does not have a correct order or spacing, I will let them know something is out of place and ask them to correct it before creating their next line of numbers. I will not specifically tell them what is out of place, I will just simply tell them something is not spaced or placed correctly. It will be their job to figure this out on their own.</p> <p>SUMMARIZE/SHARE :</p> <p>Once each group has completed their number lines, I will bring the group back together to talk about what we did. I will ask the students questions such as "What is something that you had trouble with as a group? Why is it important to</p>
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	<p>change the representation of a number in certain situations? Which numbers did you struggle with individually? Why should you know what a number is in a different form?" I will have the students reflect on what they learned today by writing down answers to some of these questions and giving examples as their homework assignment. Examples will include graphing the numbers on a number line and explaining why they placed a number in a specific location.</p>
Assessment	<p>LAUNCH: In the launch phase, I am just making sure students are comfortable with the different numbers they will be seeing. I want them to see that numbers are equivalent but can be written in a different form. I will assess their understanding of this based on their responses to my introduction to the lesson that is written on their initial note cards on their desks. I will collect these before the period ends.</p> <p>EXPLORE: I will assess student progress during this phase again informally by walking around to see if students are understanding this task individually. To indicate understanding, I am looking to see that their final answer is written as a rational number. They will be more formally assessed as I walk around and check their final answers as a group.</p> <p>SUMMARIZE/SHARE : Based on what the students hand in for homework, I will be able to formally assess if they seem to understand why numbers are written certain ways and how to graph such numbers on a number line. By having them answer my questions and give their own examples, I am hoping it will be clear whether or not they understand how to graph on a number line.</p>
<p>Reflections <i>This section to be completed only if lesson plan is implemented.</i></p>	<p>Student Work Sample 1 – Approaching Proficiency:</p> <p>Student Work Sample 2 – Proficient:</p> <p>Student Work Sample 3 – Exceeds Proficiency:</p>